

Piezoelectric Single Crystal Production

Improving the Acoustics of U.S. Navy SONAR Devices Through Advanced Crystal Technology



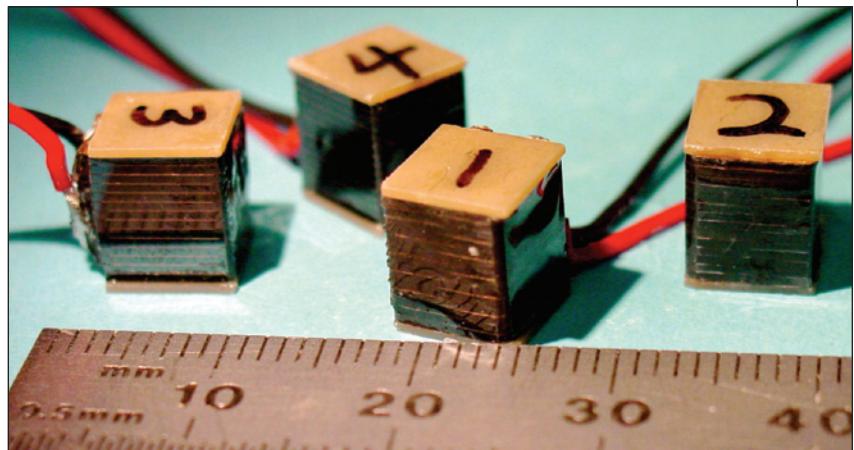
Technology and Innovation

With the shift of sea warfare to the littoral environment, where shallow waters, noisy environments, and constricted areas all increase the danger to military vessels and personnel, there is significant need for better detection and countermeasures systems. Effective use of unmanned underwater vehicles requires small systems with minimal energy requirements for sonar components.

For this DARPA SBIR program, TRS Technologies, Inc. (TRS) focused on the optimization of the Bridgeman process for the production of PMT-PT crystals greater than 2 inches in diameter, which are used in Naval SONAR devices, military electromechanical actuators, and medical acoustic transducers. The materials technology developed under this SBIR promises to add an additional crystal supply stream. The increased availability of crystals will facilitate development efforts that are dramatically advancing the performance of acoustic transducers and actuators in the form of increased sensitivity, broader bandwidth, higher strains, and higher acoustic power. One advantage is that a single device can be used to both transmit and receive acoustic signals.

Joint Collaborations

TRS collaborates with other companies and universities on most of its government-funded research. The company strives to develop and improve long-term relationships with its customers and collaborators in industry and



academia. These close partnerships have resulted in numerous patents and licenses for advanced capacitors and single crystal-based transducers and actuators.

DARPA SBIRs have allowed TRS to develop core technology that helps attract partners for developing and commercializing the technology. Through various Navy programs, TRS is addressing the Navy's specific use of the technology, continuing crystal growth development, and evaluating commercialization possibilities. The technology developed under the DARPA SBIR has also garnered interest from large device manufacturers and government prime contractors, to which TRS can license its technology.

TRS is establishing more strategic alliances with prime contractors and medical OEMs (original equipment manufacturers). Working with these organizations helps the company navigate complex regulatory, procurement, and other requirements for new government and commercial applications.

Single crystal piezoelectric-based stacked actuators



Bridgman-grown boule of piezoelectric PMN-PT single crystal

Lessons Learned

- Maintain good communication with technical monitors, determine your commercialization path as early as possible, and know the potential markets.
- As early as possible, think ahead to subsequent phases (II, III).
- Be sure you understand the rules before you submit your bid. Contracting rules and procedures are complex and agency specific.
- Be aware of International Traffic in Arms Regulation (ITAR) and export control restrictions.
- Although prime contracting is typically preferred, be a subcontractor if that can help increase the probability of award and advance the technology's commercial platform.

Economic Impact

The innovative material being developed under SBIRs is of strategic importance to many potential TRS products currently in the company's development pipeline. Approximately 80 to 90 percent of the company's government funding to date has been from SBIR/STTR programs, of which about 10 percent has been from DARPA.

The DARPA SBIR has produced a high-capacity, reproducible process that has allowed the company to develop more sophisticated, higher-value products. As a result, TRS is transitioning from being a materials company to a device company with higher value-added products.

About the Company

TRS Technologies, Inc. is located in State College, Pennsylvania and specializes in the development and application of tailored piezoelectric ceramics, single crystals, and capacitors for high-stress environments. The company's vertical product approach includes offerings ranging from raw powders to devices, in quantities of one or one thousand. TRS currently has 36 employees and annual revenues of \$4.5 million. ■



A variety of high-voltage, high-precision multilayer capacitors

Company Information

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President
Founded: 1991
Number of employees: 36